

markable researches by which he has partially answered some of the most difficult questions as to the relation of matter to ether, which are perplexing the best physical investigators of the time.

Born in 1819, Fizeau was only thirty years of age when his paper, "Sur une expérience relative à la vitesse de propagation de la lumière," appeared in the *Comptes rendus*. In this he put forward his plan of rotating a wheel having round its rim alternate teeth and spaces of equal width, so that these teeth and spaces should alternately intercept and allow to pass a beam of light from a source, and so adjusting the speed of rotation that the time occupied by the light in travelling from the wheel to a mirror and back again, should be equal to the time taken by the rim of the wheel to advance through a space equal to an integral number of times the width of a tooth or space. Curiously enough, the other experimental method of finding the velocity of light was described by Foucault in the very next volume of the *Comptes rendus*. In some respects the latter method—that of the revolving mirror—was even more striking than that of Fizeau. It allowed the velocity of light to be determined within an ordinary room, and, besides, enabled the question as to whether light travelled more or less quickly through a more refractive medium to be decided by direct experiment.

Another experiment of capital importance with which the name of Fizeau will ever be honourably associated is that by which he determined the amount of drift of light-waves in a transparent medium in motion. According to a theory given by Fresnel, the velocity of drift of ether-waves in a medium moving with velocity u is $(1 - 1/\mu^2)u$, where μ is the index of refraction of the medium. This conclusion of Fresnel was verified more lately by the experiments of Airy and Hoek, which proved, in opposition to the statement of Klinkerfues, that no change in the constant of aberration is observed when the tube of the observing telescope is filled with water. But it was tested directly by Fizeau in the most simple and beautiful manner. Two tubes were arranged side by side, and water was forced at a considerable speed (as much as seven metres per second) along one tube and back by the other, while a beam of light was split into two parts, which were sent round the tubes, one with the stream, the other against the stream, and then brought together again and tested for interference produced by the virtual difference of path traversed, arising from the motion of the water. The result gave exactly the formula quoted above, and has been confirmed by very careful experiments made comparatively recently by Michelson and Morley.

Fizeau made some notable observations on the number of interference bands observable with approximately homogeneous light, and, in conjunction with Foucault, carried out a most important series of observations on the light in different parts of the field of illumination in interference experiments. The method consisted in applying the spectroscope to examine the light taken from a narrow part of the field parallel to the bands, and proved *inter alia* that there is really interference in that region of the field which seems to be uniformly illuminated in consequence of overlapping produced by want of perfect homogeneity of the light.

One very important recent result of such observations has been to show that the detection of interference is limited only by the resolving power of the spectroscope employed, and that the usual inference as to the regularity of the vibrations in a source of light is unjustifiable.

Like Joule in this country, Fizeau carried on scientific research largely from his own private resources; and by a long series of most valuable papers published in the *Memoirs of the French Academy* and elsewhere, he has earned the gratitude of his countrymen and the world. But his most enduring memorial will doubtless be his

determination by simple laboratory apparatus of the velocity of light (a velocity sufficient to enable the earth's path round the sun to be traversed in about twenty-six minutes!), and with his great colleague Foucault he will be held in honoured remembrance so long as men study the science of optics.

Fizeau was elected a Foreign Member of the Royal Society in 1875, and he received the Rumford Medal of the Society in recognition of his scientific work.

A. GRAY.

NOTES.

THE monument to Lobachevsky, erected at Kazan, in a square which bears the name of the great geometer, was unveiled on September 13, in the presence of the Bishop of Kazan, the Governor of the province, the University, the local Physical and Mathematical Society, and a great number of sympathisers. The Mayor of Kazan made a statement as to the funds raised for the erection of the monument. Prof. Suvoroff referred to the scientific work of Lobachevsky in mathematics and physics, and Prof. Vasilieff spoke of the great geometer as one whose life was worthy of emulation, and as an energetic worker for spreading scientific knowledge. In the evening the Physical and Mathematical Society held a special commemoration meeting before a distinguished gathering of visitors of both sexes.

A SERIES of *fêtes* have been celebrated at Alais, in the centre of the great mulberry and silkworm district of France, in commemoration of the services rendered by Pasteur to sericulture. A statue of Pasteur was unveiled during the celebrations; and, on Saturday last, a solemn service was celebrated in the cathedral in commemoration of the first anniversary of his death, which occurred on September 28, 1895.

THE Harveian oration is to be delivered before the Royal College of Physicians, on October 19, by Dr. J. Frank Payne.

It is proposed to establish an International Botanical Station at Palermo, under the superintendence of Prof. Borzi, who desires the co-operation of botanists of all countries.

DR. A. ZIMMERMANN has been appointed botanist to the section of the Botanic Garden, Buitenzorg, Java, devoted to the cultivation of coffee.

THE Graefe gold medal, which is awarded by the German Ophthalmological Society every ten years, has this year been awarded to Prof. Theodore Leber, of Heidelberg, in recognition of his work on inflammation. Prof. von Helmholtz was the first to receive the medal, the award being made for his discovery of the ophthalmoscope, and his treatise on physiological optics.

A GAS exposition, beginning on January 25, 1897, is to be held for two weeks in the Madison Square Garden, New York. The object of the exposition, according to the prospectus, is to bring together a collection of gas apparatus and appliances of every description, for the purpose of affording the general public and the gas engineer an opportunity to study the developments that have taken place in the gas industry during recent years.

THE French Medical Press Association is organising a memorial festival in honour of the jubilee of the discovery of anaesthesia. The festival will take place in Paris, on October 18 and following days. The programme includes a ceremonial meeting at the Sorbonne, a banquet, and a special performance at one of the theatres. A suitable commemoration of the event is being arranged in Boston (Mass.), where the first

surgical operation under ether was performed on October 16, 1846. The Society of Anæsthetists, of London, is also taking steps to celebrate the occasion in a fitting manner.

THE Peary expedition has returned to Sydney, Cape Breton, from Greenland, but without the great meteorite which it hoped to bring back. This enormous block of metal, which Lieut. Peary set out to fetch, weighs about forty tons, and is situated on an island twenty miles inside Cape York. The jackscrews designed to lift the mass upon shipboard proved not to be strong enough, so another journey will have to be undertaken to secure it. Meanwhile we trust that the Esquimaux, who have used the meteorite as a source of workable iron for many years, will not greatly reduce the mass before another attempt is made to remove it. In spite of this disappointment, the members of the expedition have not returned empty-handed; for their collections and observations appear to be valuable and varied.

THE meeting of the American Public Health Association was held at Buffalo, September 15-18, the President, Dr. Eduardo Licéaga, of Mexico, in the chair. Delegates, thirty-five in all, were present from nearly every State in Mexico, from most of the United States, and from Canada. The work of sanitation thus received an impetus throughout the American continent; and such diseases as yellow fever, small-pox, diphtheria, &c., are waning under the vigilant efforts of the combined army of health officers. Diligent attention to business, and rigid enforcement of time limits, enabled the Association to complete a long and valuable programme of reports and papers, besides adopting several important resolutions. As to the place of meeting next year, the advisory council recommended Toronto. Motions were made to substitute Nashville and Philadelphia, and the final vote favoured the latter, which will accordingly be the place of the next (being the twenty-fifth) meeting of the Association. The officers elected are:—President, Dr. H. B. Hornbeck, of Charleston, S.C.; first Vice-President, Dr. Peter H. Bryce, of Toronto, Canada; second Vice-President, Dr. Ernest Wende, of Buffalo, N.Y.; Treasurer, Dr. Henry H. Holton, of Brattleboro', Vt.

WE regret to record the death of Sir John Erichsen, the distinguished surgeon, at the age of seventy-eight. He was elected a Fellow of the Royal Society in 1876, and since 1887 had been President of University College, London.

SIR GEORGE M. HUMPHRY, F.R.S., Professor of Surgery in the University of Cambridge, died on Thursday last, and by his death the University is deprived of one through whose exertions the medical school has been brought to the present high position. He became Professor of Anatomy in the University in 1866, and Professor of Surgery in 1883. His life affords an instance of the manner in which the development of a subject is dependent upon the bearing of University authorities towards it. When he was appointed to the chair in the University, he set to work, in conjunction with the late Sir George Paget, with the object of placing the study of medicine and surgery in a more prominent and satisfactory position. To quote the *Times*: "It was a task of great difficulty, for, although as far back as 1851 the Natural-Science Tripos had been in existence, yet it attracted but a handful of students for the first twenty years. The first real impetus given to the work was when some of the colleges recognised the Natural-Science Tripos as one avenue to a fellowship. The standard of the examinations, both for the Tripos and for medical degrees, was raised, examiners not connected with the University were appointed, and open scholarships for Natural Science were offered. The result is that at the present time the Natural-Science Tripos attracts more students than any other of the honour examinations in the University, the medical school is

one of the largest in the country, and the medical degrees of the University are held in the highest estimation by the profession. He has left behind him an array of excellent professors and teachers, and has placed the study of medicine and surgery in the front rank at the University. His exertions entitle him to be regarded as one of the greatest benefactors to the University in modern times." His chief scientific work was in comparative anatomy, to which branch of knowledge he made some important contributions. Among his best-known works are "A Treatise on the Human Skeleton," 1858; "On Myology," 1872; "Old Age, and Changes incidental to it," 1889.

WITH reference to the recent disastrous gales and torrential rainfall over the British Islands, the *Weekly Weather Report* of September 26 shows that the changes brought about in barometric pressure were very great, amounting to considerably over an inch in twenty-four hours at many places. The rainfall was much in excess in all districts, especially in the western parts of the country; falls exceeding an inch in twenty-four hours have been reported on several days. The total rainfall since the beginning of the year is still below the average, except in the north of Scotland and the north of Ireland. The greatest deficiency is in the south-west of England, where it amounts to nearly seven inches.

A LUNAR bow, in which the various prismatic colours could be distinguished without difficulty, was observed at Portmadoc, North Wales, last Sunday evening, by Mr. Walter Williams, who has sent us a description of the phenomenon. The time at which the bow was seen was 9.40 p.m. The colours appeared on the western edge of a dark rain-cloud, which was moving rapidly towards the east. This cloud was apparently very much in advance of another thin cloud, of pearly whiteness, surrounding the moon's disc; nevertheless the two clouds seemed continuous, and the soft silky whiteness of the one formed a sharp contrast to the coloured bow on the edge of the other. There were no more clouds in the immediate vicinity of the moon. The bow was visible for a length about twelve times greater than the moon's apparent diameter. Violet was the innermost colour, and there was a sharp contrast between it and the white cloudiness. The whole phenomenon only lasted four minutes.

IN a valuable memoir recently published in the *Annali* of the Central Meteorological Office of Rome, Prof. Arcidiacono describes the Syracuse earthquake of April 13, 1895, which disturbed the whole of the south-east corner of Sicily. The centre of the epicentral area is at the village of Vizzini, and its longer axis lies along a line joining this place with Cape Passero. It is interesting to notice that this line coincides nearly with the axis of the ridge of Monte Lauro, and also joins the two principal volcanic centres (now extinct) of the Val di Noto. At the epicentre the intensity was 9, according to the Rossi-Forrel scale; in other words, the shock was sufficiently strong to damage buildings, but not to destroy them entirely. On the map which illustrates his paper, Prof. Arcidiacono shows the course of eight isoseismal lines, and, using the method of Dutton and Hayden, estimates the depth of the seismic focus to be about 7.4 km.

IN the *Revue Scientifique* (No. 11) will be found the communication made by M. Stokvis to the International Colonial Institute on the question of colonisation in tropical regions. The author speaks strongly in favour of successful colonisation by Europeans in low latitudes, and brings evidence together showing that with due regard to hygiene the European is practically as well off as the native. The conclusions which he eventually arrives at are: (1) That the establishment and prosperity of European colonies, whether they be for purposes of "exploitation" or agriculture, are perfectly possible in both

high and low tropical regions. (2) In the question of colonisation, tropical temperatures and the race of the colonist play only secondary rôles. (3) Colonisation on a large scale—that is colonisation of the masses—ought to be stopped.

A NEW volume of the late Baron Uslar's great work on the languages of the Caucasian mountaineers has just been issued at Tiflis, by the Department of Education. It is devoted to the Kyurin language. The Kyurins are a small stem, inhabiting the banks of the Samur river, in the north of the Daghestan plateau. For a long time they were under the rule of the khans of Derbent, Kuba, or Kazikumukh; but in the second half of the last century a separate Kyurin khanate came into existence, and maintained itself up to 1866, when it was conquered by the Russians. The Kyurin language, which has many sub-branches, must be considered as an independent linguistic unit, while its pronunciation varies with nearly every separate village. The first part of Baron Uslar's work contains a description of the leading features of the language and its grammar; while the second part is a dictionary of Kyurin words.

The current number of the *Zoologist* contains an interesting article, by Mr. A. Holte Macpherson, on "Some Observations on the Note of the Cuckoo." During the spring and early summer of the present year the author took every available opportunity of listening to the cuckoo, and enlisted in his service many friends to do the same, his purpose being to determine, if possible, the pitch of the bird's voice, and the duration of the interval between the notes of its call. An analysis of the reports in his hands shows that when the bird is in full song the interval is usually greater than the minor third, and is to all intents and purposes a full major third. Not infrequently the bird utters three notes. At Haileybury, on June 7, it was heard to sing E flat, D C two or three times, then it omitted the middle note, singing a minor third. Two other birds are reported to have sung F F C and F, D flat, and C, respectively. As regards the pitch, out of hundreds of recorded calls during the period when the bird was in good voice, the upper note in nineteen cases out of twenty was from F to E flat, and the lower note from D to B. The author comes to the conclusion that the average call is E and C in the middle of the piano.

WITH its current issue, our contemporary, *Science Progress*, enters upon a new phase of its existence. It has been enlarged, and will in future appear quarterly, instead of monthly, at a slightly increased price.

Bulletin No. 57 of the Experiment Station of the Kansas State Agricultural College, Manhattan, is occupied by a descriptive list of "Kansas Weeds," accompanied by upwards of twenty plates of drawings of the leaves or other characteristic organs.

Timehri (June), the journal of the Royal Agricultural and Commercial Society of British Guiana, contains the following scientific contributions: "Multiple Evaporation," by W. P. Abell; "Queer Homes" (an account of nests built in peculiar places), by C. A. Lloyd; "Note on Berbice Bats," by Dr. C. G. Young; "India-Rubber Collection at Para," by J. A. Coelho. In addition to the foregoing, there are a number of articles of commercial interest.

MR. BERNARD QUARITCH has sent us his catalogue, dated September, containing a great many works relating to mathematics, microscopy, mountaineering, naval sciences, ornithology, palæontology, travels and zoology. Among the books mentioned we notice a complete set of the "Philosophical Transactions of the Royal Society," with general indexes; a set of the "Transactions of the Linnean Society," from 1791 to 1891; the "Proceedings and Journal of the Linnean Society," from 1838 to 1895; and the "Proceedings of the Zoological Society," from 1830 to 1894.

NO. 1405, VOL. 54]

A CATALOGUE of meteorites in the collection of the American Museum of Natural History, New York, by Mr. E. O. Hovey, has been received. The collection consists of fifty-five slabs fragments and complete objects, representing twenty-six falls and finds. The source of each specimen, also the dates of discovery, and the individual weights in grams, is given in the catalogue, which should be of interest and service to many visitors to the museums and others.

WE have received the *Bulletin of Miscellaneous Information* of the Royal Botanic Gardens, Trinidad, for July. Among the "Natural History Notes" is a very interesting account of the life-history of the parasol ants, *Atta cephalotes* and *octospinosus*, with drawings of the various forms—the male, queen, soldier, worker major, worker minor, nurse, and gardener. Mr. J. H. Hart, the Superintendent, confirms the statement of Belt that these ants carry vegetable matter into their nests, not as food, but as a material on which to grow the fungi on which they feed. The destruction caused by various species of parasol ant in the Western Tropics is a matter of very serious importance to the agricultural industries.

WE have received the *Bulletin Meteorologique et Seismique de l'Observatoire Imperial de Constantinople* for February of this year. In this is given a list of the earthquakes observed during this month in the East, and more especially those occurring in the Ottoman Empire. The number seems to be considerable, no less than twenty-nine being described. The meteorological observations for this month are also given, the Director of the Observatory, Salib Feky, adding a *résumé* and his usual monthly *revue climatologique*.

THE additions to the Zoological Society's Gardens during the past week include two Bonnet Monkeys (*Macacus sinicus*, ♀ ♀) from India, presented by Mrs. Strutt; a Macaque Monkey (*Macacus cynomolgus*, ♀) from India, presented by Mr. J. Laverock; a Ring-tailed Coati (*Nasua rufa*) from South America, presented by Miss M. E. Clarke; a — Squirrel (*Sciurus* sp. ?) from Monrovia, West Africa, presented by Mr. Ellis Edwards; an Orange-cheeked Amazon (*Chrysotis autumnalis*) from Honduras, presented by Mr. Baratti; a Common Heron (*Ardea cinerea*), British, presented by Mr. E. J. Poyser; four Montague's Harriers (*Circus cineraceus*), British, presented by Mr. W. J. Laidlay; three Pin-tailed Sand Grouse (*Pterocles alchata*) from Spain, presented by Mr. G. P. Torrens; six Rough Terrapins (*Clemmys punctularia*) from Para, presented by Dr. E. A. Goeldi; a short-tailed Wallaby (*Halmaturus brachyurus*) from Australia, deposited; two Ruffs (*Machetes pugnax*), British, purchased; an African Lepidosiren (*Lepidosiren annectans*) from West Africa, received in exchange.

OUR ASTRONOMICAL COLUMN.

THE SOLAR ROTATION.—In the August number of the *Astrophysical Journal* there is a brief summary of the work being done at John Hopkins University by Mr. Lewis Jewell. These researches dealt with the question of the solar rotation, and Mr. Jewell's recent work in measuring a large number of lines in photographs of the solar spectrum has brought out, as is stated, a new and remarkable peculiarity in the law of the solar rotation. The following is a brief extract of the note in question. "It is found that there is a difference of several days in the rotation periods of the outer and inner portions of the sun's atmosphere, the period increasing as the photosphere is approached. The measures also show the equatorial acceleration to be much the greatest for the outer portions of the atmosphere. At the lower levels the acceleration is small, there being little difference in the periods for different latitudes. It is further found that the carbon (cyanogen) lines and the shaded portions of H and K take their rise very low down in the solar atmosphere. Mr. Jewell is at present engaged upon the reduction of the measures."